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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/521,901	03/09/2000	Tsutomu Yamakawa	0039-7608-2S	2826

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EXAMINER
LEE, SHUN K

ART UNIT	PAPER NUMBER
2878	

DATE MAILED: 10/15/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/521,901	YAMAKAWA, TSUTOMU	
	Examiner	Art Unit	
	Shun Lee	2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 July 2002 & 15 August 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17 and 22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17 and 22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on *27 December 2001* is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Prosecution Application

1. The request filed on 15 August 2002 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 09/521,901 is acceptable and a CPA has been established. An action on the CPA follows.

Drawings

2. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 27 December 2001 have been approved. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance. In response to applicant's remarks (see second paragraph on pg. 7 of remarks filed 15 July 2002), it should be noted that a clean copy of the amended drawing was unfortunately not found.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-9, 11-17, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamae *et al.* (US 4,857,737) in view of DiFilippo *et al.* (US 5,793,045).

In regard to claims **1** and **14**, Kamae *et al.* disclose a nuclear medical diagnostic apparatus comprising:

(a) at least one radiation detector (S1, S2, Sn in Fig. 2), each radiation detector having a plurality of semiconductor cells (*i.e.*, diodes; column 1, lines 51-56) that (1) are arranged in a matrix, (2) detect radiation separately, and (3) output signals representing an energy of the radiation separately (column 6, lines 6-58; column 7, lines 35-55);

(b) a selection circuit (*i.e.*, suitable electronic circuit and computer; column 7, lines 35-41) which, in order to select, among events wherein the radiation is detected, a specific event wherein radiation derived from radio-isotope injected to a subject is detected (column 1, lines 21-40), wherein one or more semiconductor cells in the semiconductor cell array one or more output signals substantially simultaneously (*i.e.*, chronological order is not directly detected since it is extremely difficult to determine the sequence of signals when the plurality of reactions are measured almost simultaneously; column 6, lines 51-54; column 7, lines 10-16; and column 9, lines 8-11) due to Compton scattering and/or photoelectric absorption, and in a second case wherein not less than two semiconductor cells in the semiconductor cell array output not less than two signals substantially simultaneously (*i.e.*, $N > 1$), calculates a total energy of the not less than two signals and compares the total energy with the predetermined energy window (column 7, lines 16-19 and 47-68);

(c) a position calculation circuit (*i.e.*, suitable electronic circuit and computer; column 7, lines 35-41) which in the second case determines (column 8, lines 1-24) the

sequence of the reactions, and thus calculates an incidence position (*i.e.*, coordinates of the first reaction point x_1, y_1, z_1) of the radiation based on a position (*i.e.*, coordinates of the i-th reaction point x_i, y_i, z_i; column 7, line 54) of only one of said not less than two semiconductor cells;

(d) a counting circuit (15 and 16 in Fig. 7) configured to count the specific event in association with the calculated incidence position (column 8, lines 61-67); and

(e) a circuit (15 and 16 in Fig. 7) configured to generate a distribution of radio-isotope in the subject on the basis of a counting result (column 8, line 67 to column 8, line 2).

The nuclear medical diagnostic apparatus of Kamae *et al.* lacks a explicit description of a first case wherein only one of said semiconductor cells in the semiconductor cell array output a signal (*i.e.*, N = 1) and compares an energy of the signal with a predetermined energy window so as to calculate an incident position. Compton scattering and photoelectric absorption are well known in the art. For example, DiFilippo *et al.* teach (column 1, line 6 to column 2, line 5; column 3, lines 44-60) that there is a photopeak energy window (see Fig. 3) at the incident gamma ray energy (*i.e.*, 511 keV), wherein a detected event which is within the photopeak energy window is unlikely to have been Compton scattered (*i.e.*, is a N = 1 photoelectric absorption only event) and thus the positions of these N = 1 events can be determined with a high degree of confidence. Therefore it would have been obvious to one having ordinary skill in the art to compare the energy of the N = 1 signal with a predetermined photopeak energy window in the apparatus of Kamae *et al.*, in order to determine that the N = 1 signal is a N = 1

photoelectric absorption only event wherein the coordinates of the only reaction point x_1, y_1, z_1 is the incidence position as taught by DiFilippo *et al.*

In regard to claim **12**, Kamae *et al.* in view of DiFilippo *et al.* is applied as in claim 1 above. Kamae *et al.* also disclose (column 9, lines 41-52) the exclusion of $N > 1$ scattering events by determining if the detected energy is outside a predetermined window which are events wherein at least two semiconductor cells output at least two signals substantially simultaneously and do not contribute to imaging.

In regard to claim **2** (which is dependent on claim 1), claim **13** (which is dependent on claim 12), and claim **15** (which is dependent on claim 14), the apparatus of Kamae *et al.* lacks an internal coincidence circuit configured to determine the second case on the basis of a time difference among a plurality of signals output from said at least one radiation detector. DiFilippo *et al.* teach an internal coincidence circuit configured to determine a time difference among a plurality of signals output from said radiation detector in order determine if signals occur within a predetermined time interval (*i.e.*, second case, column 5, lines 33-44). Therefore it would have been obvious to one having ordinary skill in the art to provide an internal coincidence circuit in the apparatus of Kamae *et al.*, in order to determine if signals occur within a predetermined time interval (*i.e.*, second case) as taught by DiFilippo *et al.*

In regard to claims **3-7** which are dependent on claim 1, Kamae *et al.* also disclose (column 8, lines 1-24) that in the second case, said position calculation circuit selects one semiconductor cell (*i.e.*, coordinates of the i-th reaction point x_i, y_i, z_i; column 7, line 54) from said not less than two semiconductor cells on the basis of an

energy (*e.g.*, a minimum energy or a maximum energy depending on the Eq. in column 8) of the not less than two signals and the positions (*e.g.*, a first area and a second area) of said not less than two semiconductor cells.

In regard to claim **8** which is dependent on claim 1, the apparatus of Kamae *et al.* lacks a circuit configured to calculate time differences between a signal output from one of said plurality of semiconductor cells and signals output from remaining cells of said plurality of semiconductor cells. DiFilippo *et al.* teach an internal coincidence circuit configured to determine a time difference among a plurality of signals output from said radiation detector in order determine if signals occur within a predetermined time interval (column 5, lines 33-44). Therefore it would have been obvious to one having ordinary skill in the art to provide an internal coincidence circuit in the apparatus of Kamae *et al.*, in order to determine if signals occur within a predetermined time interval as taught by DiFilippo *et al.*

In regard to claim **9** which is dependent on claim 1, the apparatus of Kamae *et al.* lacks a circuit configured to calculate time differences between a signal output from either one of said plurality of semiconductor cells and signals output from remaining ones of said plurality of semiconductor cells, and determines the second case on the basis of the time differences. DiFilippo *et al.* teach an internal coincidence circuit configured to determine a time difference among a plurality of signals output from said radiation detector in order to determine if signals occur within a predetermined time interval (*i.e.*, second case, column 5, lines 33-44). Therefore it would have been obvious to one having ordinary skill in the art to provide an internal coincidence circuit in

the apparatus of Kamae *et al.*, in order to determine if signals occur within a predetermined time interval (*i.e.*, second case) as taught by DiFilippo *et al.*

In regard to claim **11** which is dependent on claim 1, Kamae *et al.* also disclose (column 11, lines 8-14) that each of said semiconductor cells has a scintillator layer and a photoelectric conversion layer (*i.e.*, plurality of scintillation counters using for example photodiodes).

In regard to claim **16** which is dependent on claim 14, Kamae *et al.* also disclose that in the second case, said position calculation circuit calculates a barycentric position of the positions of said not less than two semiconductor cells (*i.e.*, each possible position of the not less than two semiconductor cells or sequence is given a weight proportional to the probability, column 8, lines 25-47).

In regard to claim **17** which is dependent on claim 14, Kamae *et al.* also disclose that in the second case, said position calculation circuit calculates, when said two semiconductor cells output signals substantially simultaneously, an incidence position on the basis of one of the positions of said two semiconductor cells (it should be noted Kamae *et al.* teach that there are N! possible sequences of reactions with N! = 2 for 2 signals and thus an incidence position on the basis of one of the positions of the two semiconductor cells will be calculated, column 8, lines 12-27), and when not less than three semiconductor cells output signals substantially simultaneously, a barycentric position of the positions of remaining ones of said plurality of semiconductor cells obtained by excluding said detection element that has output the signal having a maximum energy (*i.e.*, each possible position of the not less than two semiconductor

cells or sequence is given a weight proportional to the probability, column 8, lines 25-47).

In regard to claim **22**, the method steps are implicit for the modified apparatus of Kamae *et al.* since the structure is the same as the applicant's apparatus of claim 1.

5. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamae *et al.* (US 4,857,737) in view of DiFilippo *et al.* (US 5,793,045) as applied to claim 1 above, and further in view of Harris *et al.* (US 5,510,644).

In regard to claim **10** which is dependent on claim 1, the modified apparatus of Kamae *et al.* lacks that each of said semiconductor cells has a layer made of cadmium telluride or cadmium zinc telluride. Harris *et al.* teach semiconductor cells having a layer made of cadmium telluride in order to obtain a x-ray detector operable at room temperatures (column 2, lines 9-11). Therefore it would have been obvious to one having ordinary skill in the art to provide cadmium telluride as the semiconductor cells in the modified apparatus of Kamae *et al.*, in order to have a x-ray detector operable at room temperatures as taught by Harris *et al.*

Response to Arguments

6. Applicant's arguments filed 15 July 2002 have been fully considered but they are not persuasive.

Applicant argues (second paragraph on pg. 8 of remarks filed 15 July 2002) that Kamae *et al.* fail to disclose calculating an incident position of the radiation based on a position of only one of the not less than two semiconductor cells that have signal outputs substantially simultaneously. Examiner respectfully disagrees. Kamae *et al.*

state (column 9, lines 8-11) that " ... for a plurality of reactions measured almost simultaneously, ΣE_i is obtained and the sum of the energies is judged to be the energy of the incident γ-ray". Thus, the plurality of reactions from a single incident γ-ray are measured almost (*i.e.*, substantially) simultaneously. Kamae *et al.* also state (column 7, lines 16-19) that "Each of the position sensitive type radiation detectors S_1-S_n is so thin that the probability that more than two Compton scatterings occur within a same layer, can be neglected". Thus, two Compton scatterings occur within the same layer cannot be neglected, whereas three or more Compton scatterings occur within the same layer can be neglected because of the low probability of three or more Compton scatterings occurring within the same layer. Kamae *et al.* further state (column 8, lines 48-57) that "In this way it is possible to estimate correctly the sequence, according to which the reactions have occured, with a high probability and to confine the direction of the incident γ-ray to a conical surface, whose apex is the electric signal generating point, where it is presumed that the 1st Compton scattering has occured, and whose rotation axis is the straight line connecting the two points, where it is presumed that the 1st and the 2nd Compton scatterings have occured, respectively, as indicated in FIG. 2". Thus, the electric signal generating point (*i.e.*, position of only one of the not less than two semiconductor cells) where the first Compton scattering (*i.e.*, incident position of the radiation) has occurred is calculated. Therefore, it is clear that Kamae *et al.* disclose calculating an incident position of the radiation based on a position of only one of the not less than two semiconductor cells which can be in the same layer that have signal outputs substantially simultaneously.

Applicant argues (first paragraph on pg. 9 of remarks filed 15 July 2002) that Kamae *et al.* does not exclude events from imaging solely on the fact that not less than two cells output not less than two respective signals substantially simultaneously, rather

on energy considerations only. Examiner respectfully disagrees. For the reasons stated above, Kamae *et al.* disclose that the plurality of reactions from a single incident γ-ray are measured substantially simultaneously. Therefore, Kamae *et al.* exclude from imaging on energy considerations events of not less than two respective signals substantially simultaneously outputted by not less than two cells.

Applicant argues (last paragraph on pg. 9 of remarks filed 15 July 2002) that Kamae *et al.* does not disclose calculating an incident position of the radiation based on the locations of only one of the not less than two semiconductor cells that output the not less than two signal substantially simultaneously. Examiner respectfully disagrees for the reasons stated above.

Applicant argues (first paragraph on pg. 10 of remarks filed 15 July 2002) that Kamae *et al.* does not disclose the calculation of a barycentric position. Examiner respectfully disagrees. Kamae *et al.* state (column 8, lines 45-47) that "If there are a plurality of consistent sequences, they are registered with the weight attached to each of the events, the total sum of the weights being 1". Thus, the barycentric position is registered (*i.e.*, calculated by the sum) of each of the event coordinates each modified by a weight (*i.e.*, the weight of a particular event is proportional to the number of occurrence of that particular event as the first scattering for the plurality of consistent event sequences), wherein the total sum of the weights being 1. For example, consider that there are 3 consistent event sequences with event A at coordinates (x_A, y_A, z_A) occurring as the first event in two of the 3 consistent event sequences and event B at coordinates (x_B, y_B, z_B) as the first event in one of the 3 consistent event sequences. Thus the weight for event A is

w_A = 2/3 and the weight for event B is w_B = 1/3 and the first event barycentric position is ($x = w_Ax_A+w_Bx_B$, $y = w_Ay_A+w_By_B$, $z = w_Az_A+w_Bz_B$).

Applicant argues (fifth paragraph on pg. 10 of remarks filed 15 July 2002) that Kamae *et al.* do not disclose an internal coincidence circuit but rather disclose the detection of coincidences among multiple detectors. Examiner respectfully disagrees. For the reasons stated above, two Compton scatterings occurring within the same layer must be considered and thus Kamae *et al.* disclose an internal coincidence circuit for the detection of coincidences (*i.e.*, substantially simultaneous events) occurring within the same layer.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shun Lee whose telephone number is (703) 308-4860. The examiner can normally be reached on Tuesday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Porta can be reached on (703) 308-4852. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SL
October 9, 2002

CONSTANTINE HANNAHER
PRIMARY EXAMINER
GROUP ART UNIT 2878